PARTICLE GENERATION AND DISPERSION MEASUREMENTS

The LTADS "Dust Experiments"

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Goal

Observe the Dynamics of Ambient Particles in the Lake Tahoe Basin

Emphasis on “Fugitive Dust”

Spatial and Temporal Patterns

Micro- and Meso- Scale Dispersion

Evolution of Size Distributions

Effects of Near-Source Deposition

Contribute to Conceptual Model of Tahoe Basin Circulation

Measurement Concepts

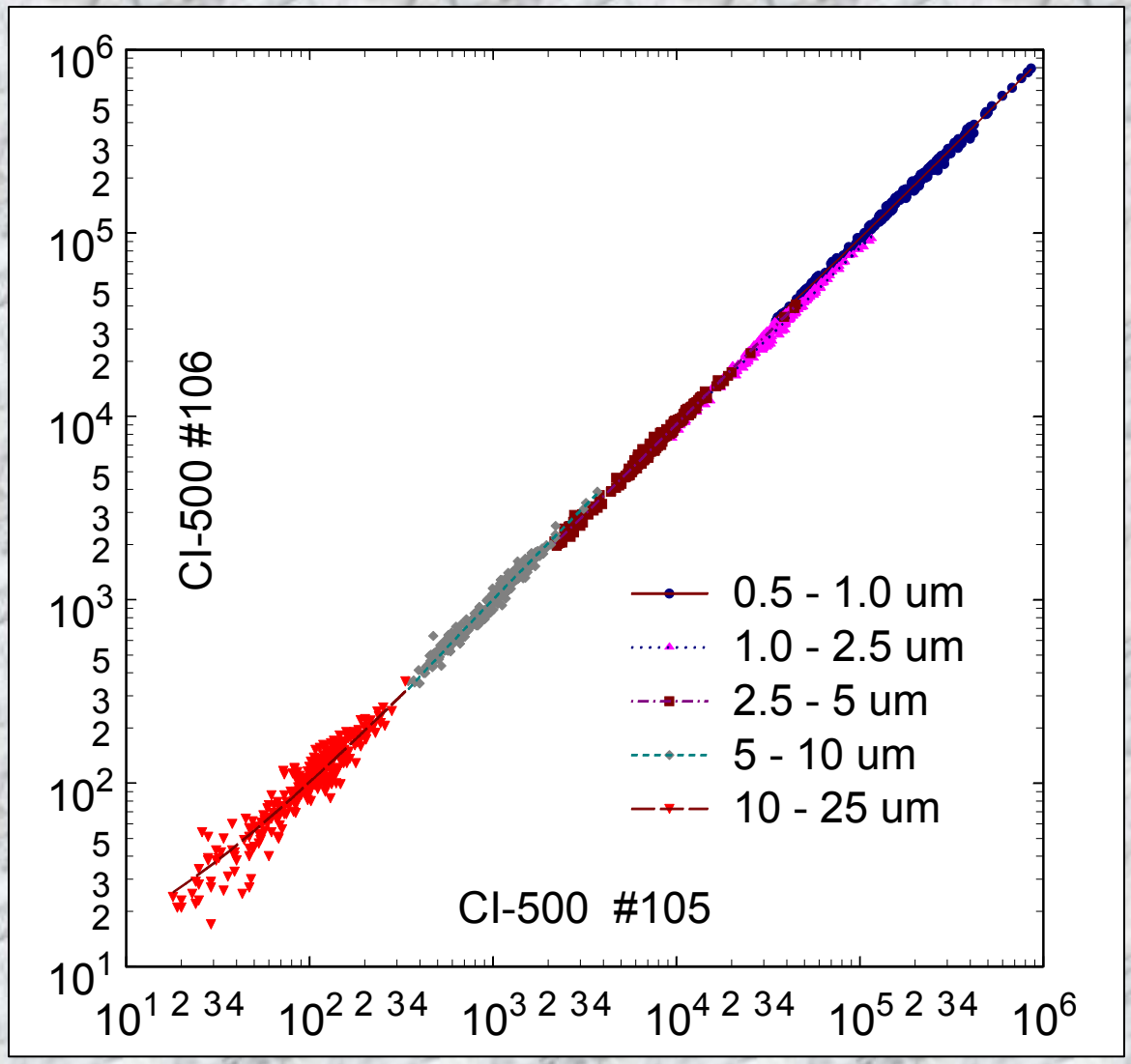
- Time- and Size- Resolved Measurements
- Understand LTADS Measurement Sites in Their Microenvironmental Context
- Link to LTADS Measurement Aerosol Speciation
- Develop Dispersion / Deposition Curves for Road Dust

Particle Counter Instrument

CLIMET CI 500 Particle Counter

- Count Bins: 0.5-1, 1-2.5, 2.5-5, 5-10, 10-25, 25+ μm
- Time Resolution Down to 1-Minute
- Supporting Data:
  - Temperature
  - RH
  - Flow Rate
- Autonomous Operation
  - 500 Sample Memory
  - Internal Battery or Line Power

Particle Counter Intercomparison

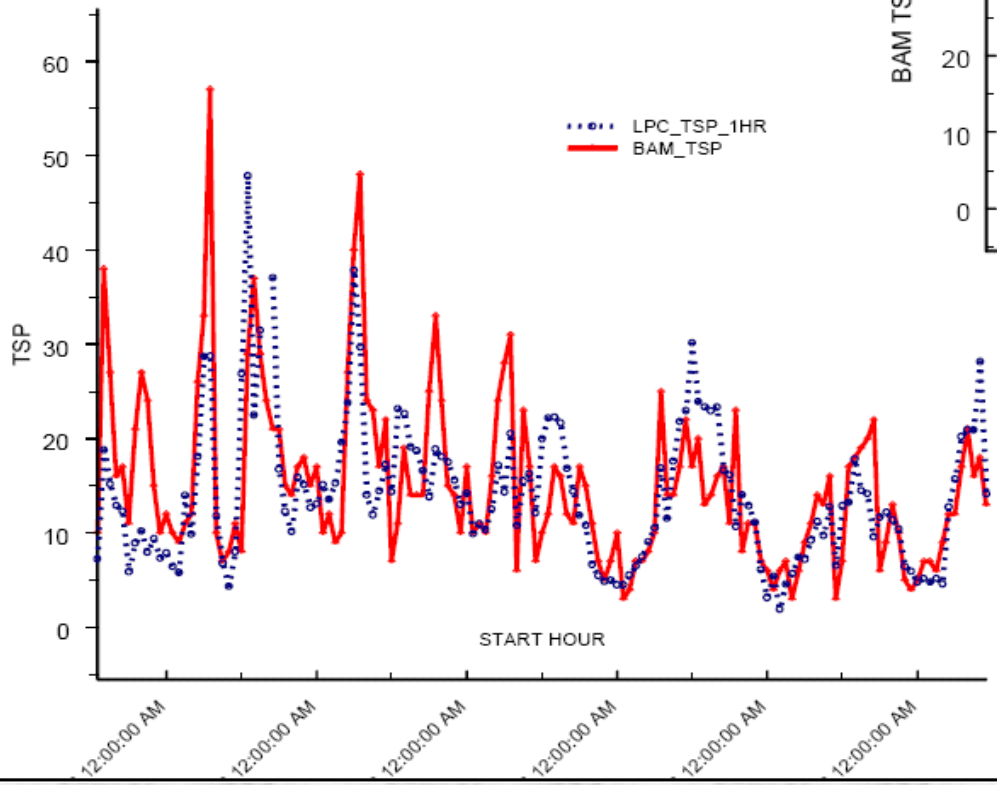


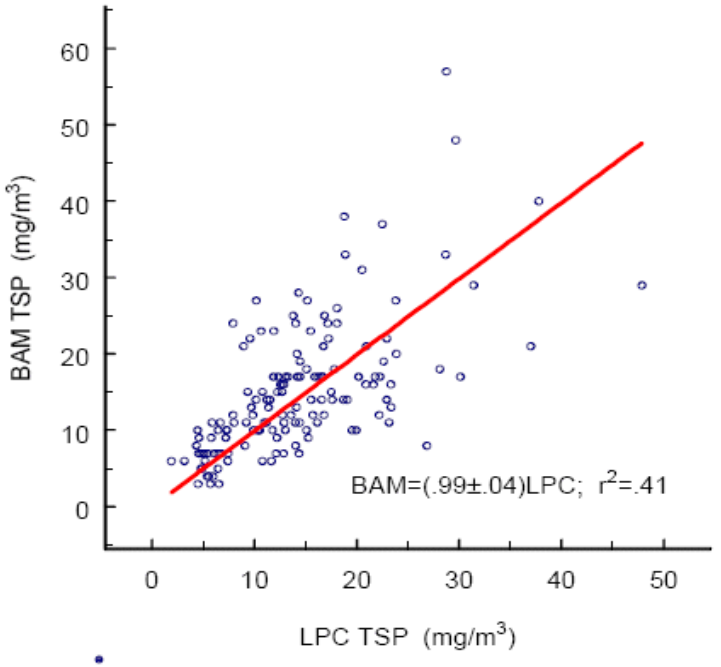
Mass-Count Relationships
Data Reduction Strategy

- Convert counts to equivalent volume of spherical particles
- Convert volume to mass by assumed particle density

SIZE BIN	GEOMETRIC MEAN DIAMETER	ASSUMED DENSITY
0.5-1 μm	0.71	1 g/cc
1 - 2.5 μm	1.58	1 g/cc
2.5 - 5 μm	3.54	1.5 g/cc
5 - 10 μm	7.07	2.0 g/cc
10 - 25 μm	15.81	2.5 g/cc
25 + μm	31.62	2.5 g/cc

Mass Estimation Validation





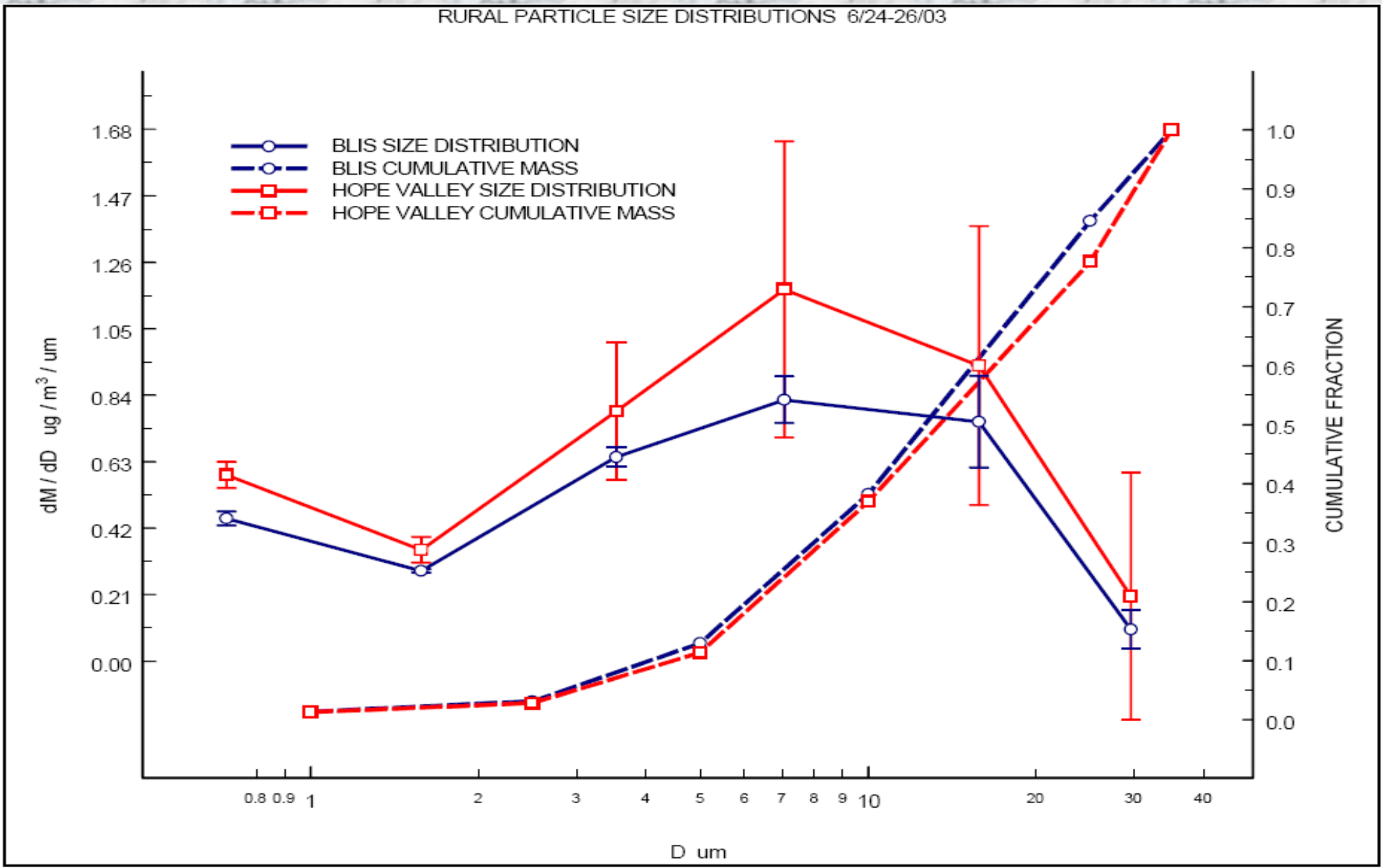
Experimental Setups

- Single Instrument
  - Spot Measurements (1hr – 1 day)
  - Time Series
    - Multi-day
    - 20-minute Time Resolution
- Arrays
  - Downwind Transects with 2 – 5 Samplers
  - 1- minute Time Resolution

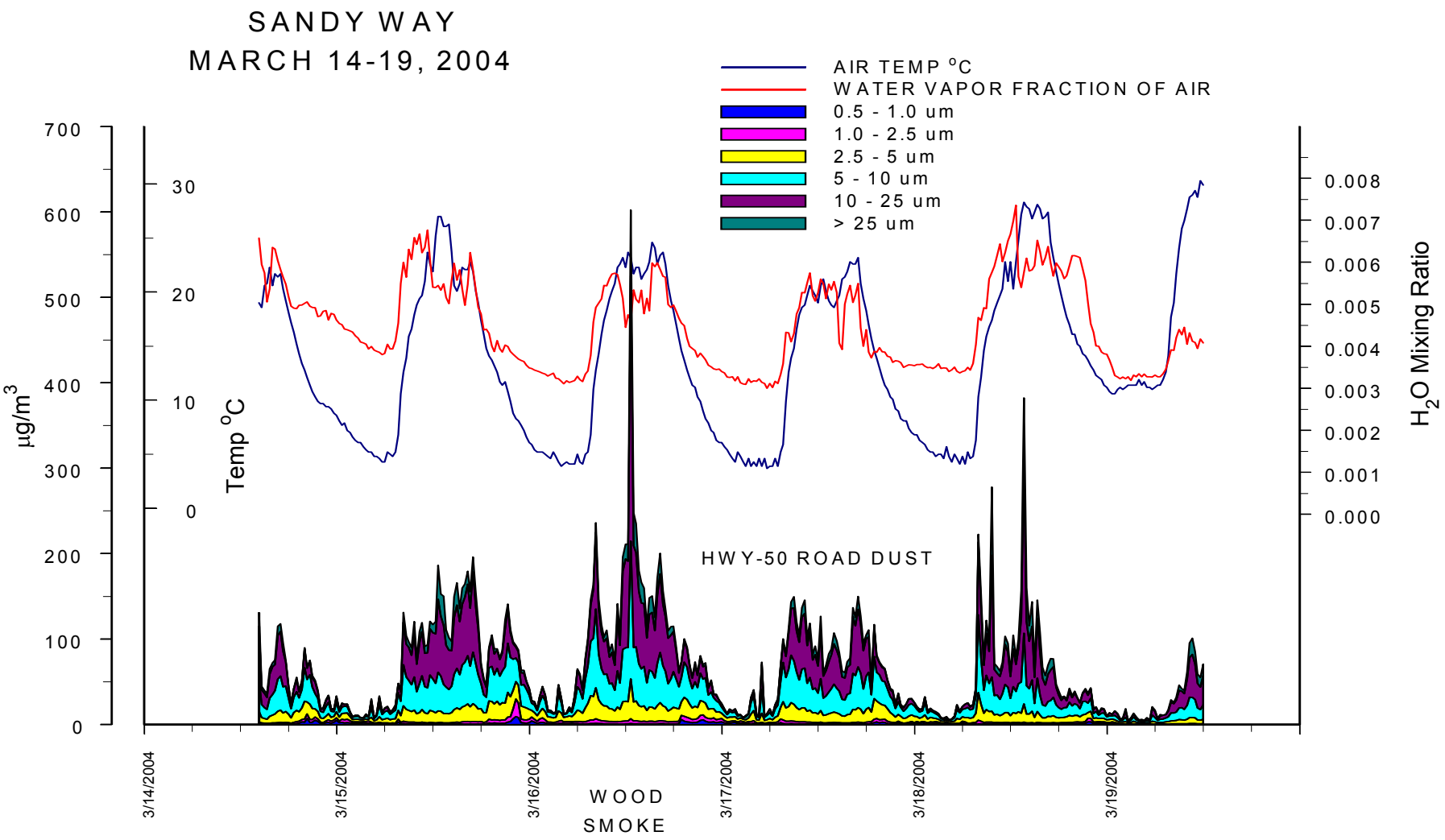
Experimental Program

- Montane “Background” Aerosol Load
  - Spot Samples and Time Series from Undeveloped Sierra Sites
- Inter-Site Comparison for LTADS Sites
  - BLIS, Sandy Way, and SOLA
  - Total PM, Size Distributions, Diurnal Cycles
- Road Dust
  - SOLA, Hwy 50 in SLT, Hwy 267 in Kings Beach

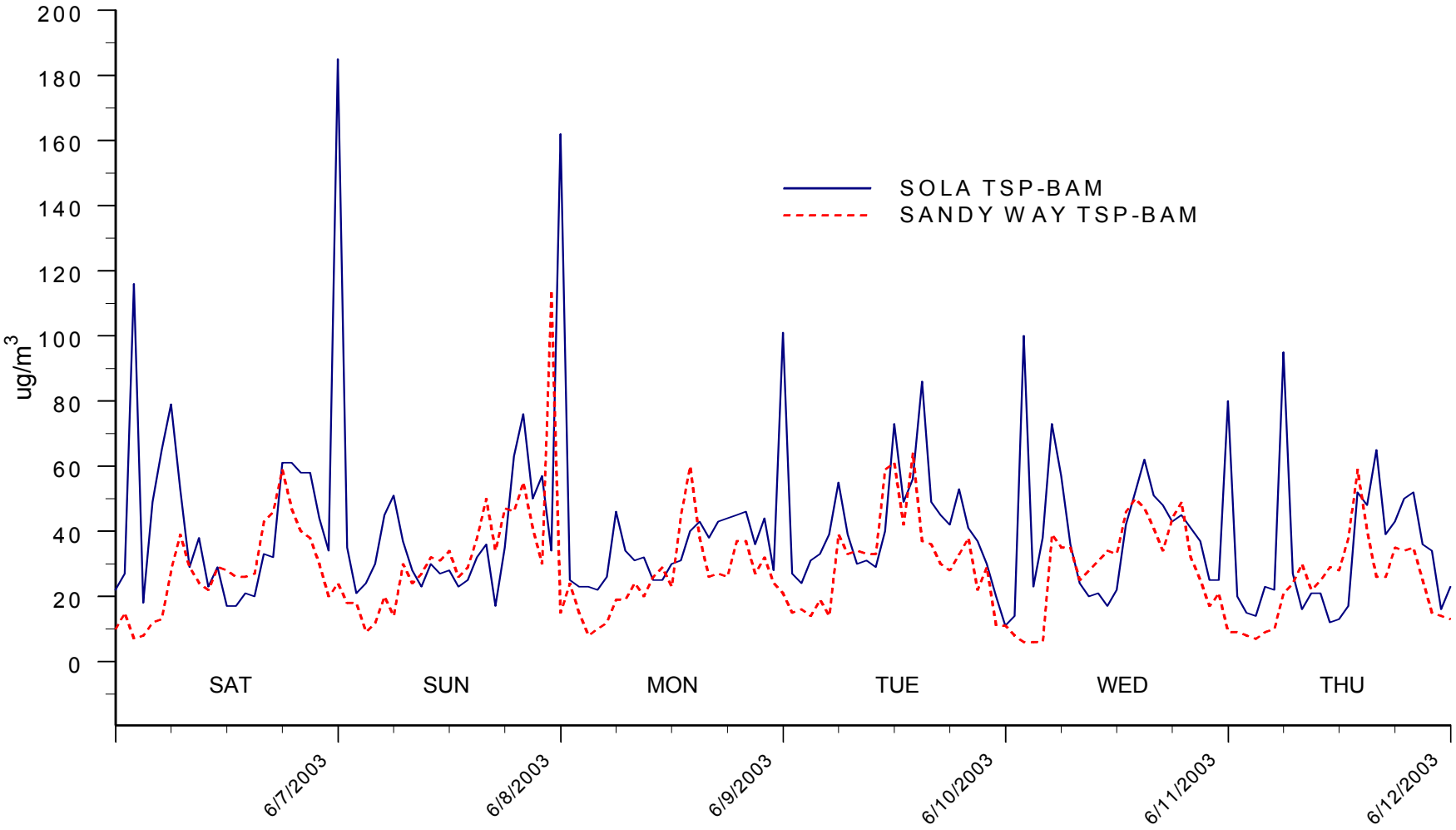
Montane "Background" Aerosol



Diurnal Variation at Sandy Way

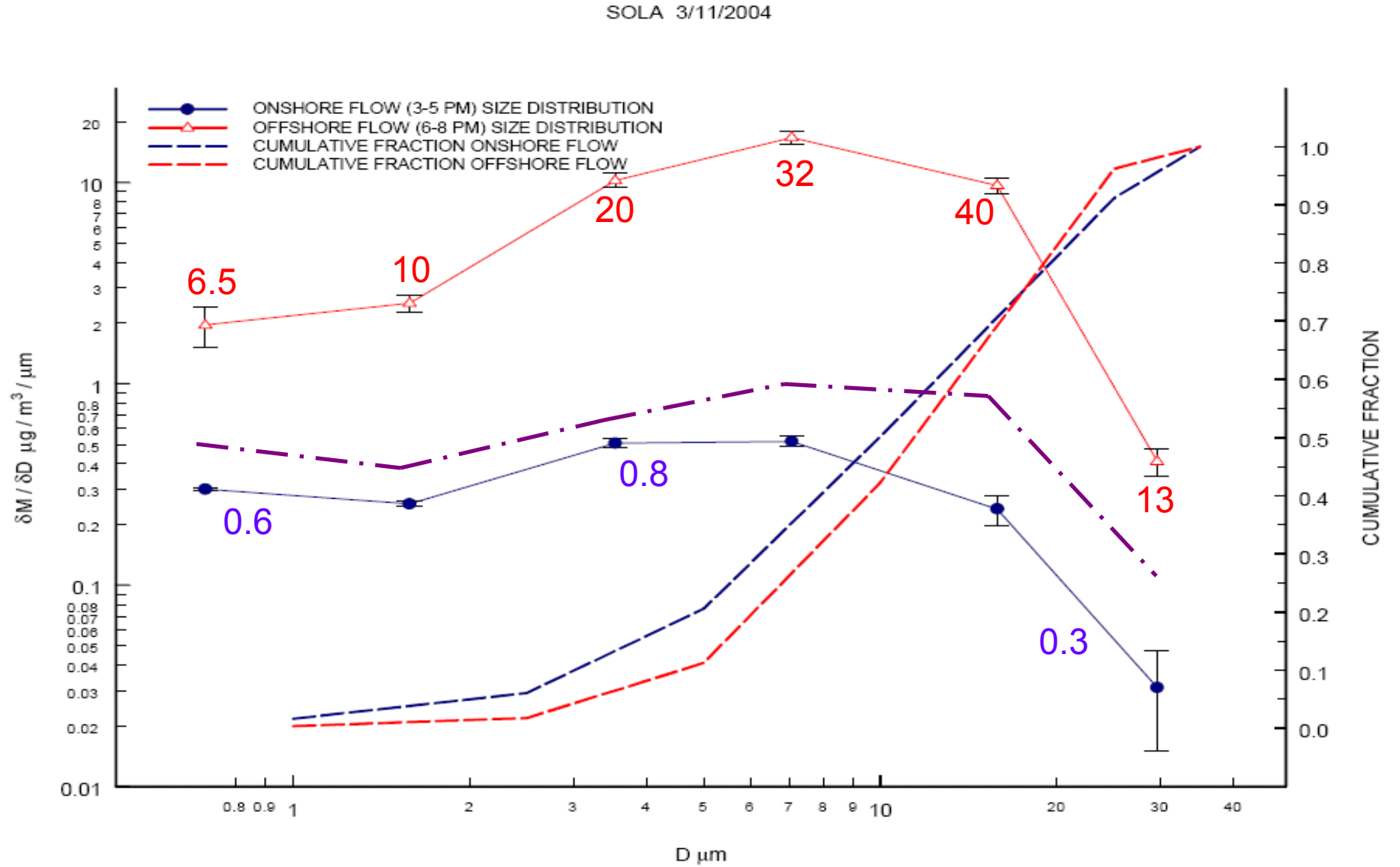


Diurnal Patterns at Sandy Way and SOLA

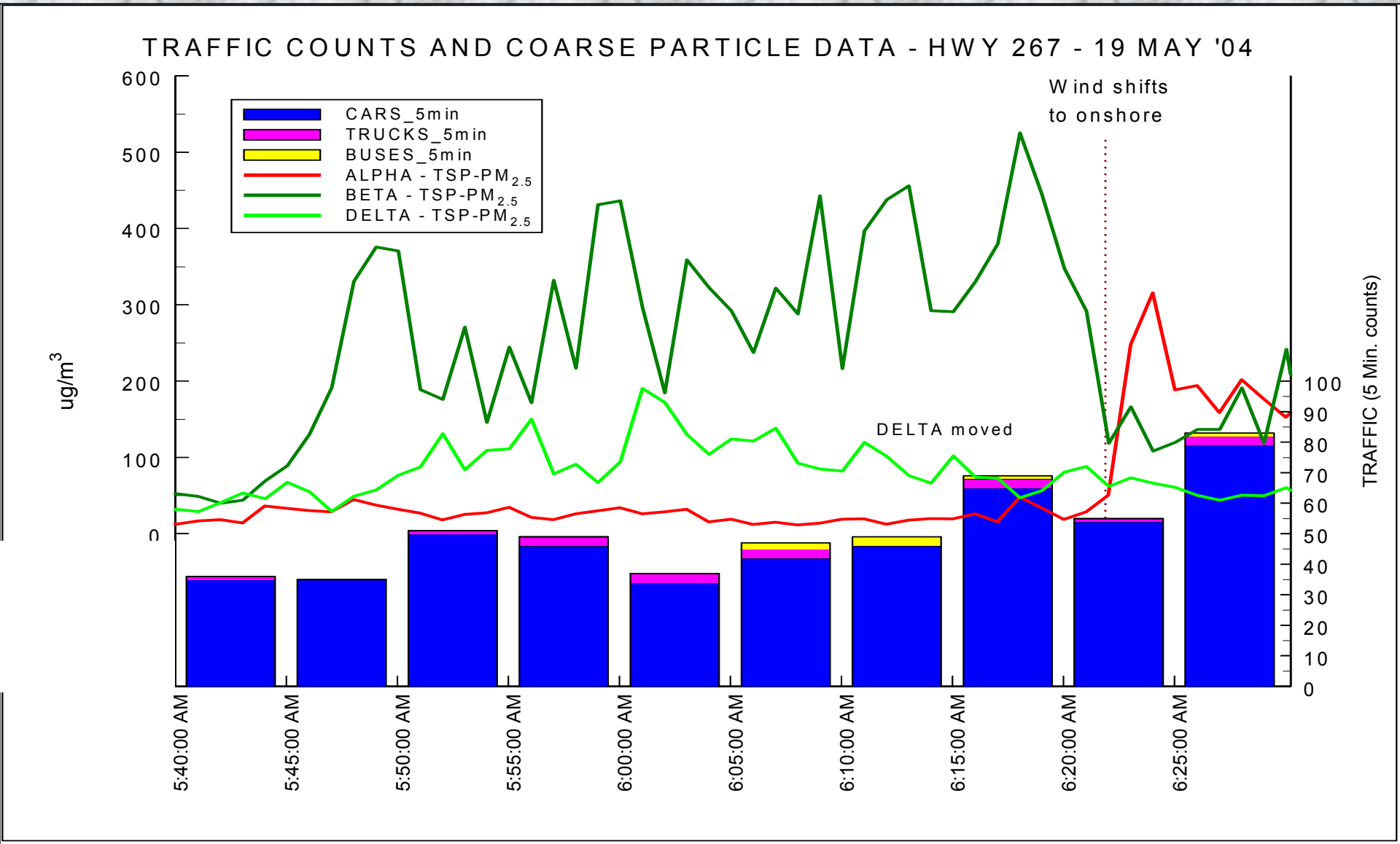


Lake Breeze *vs* Land Breeze PM at SOLA

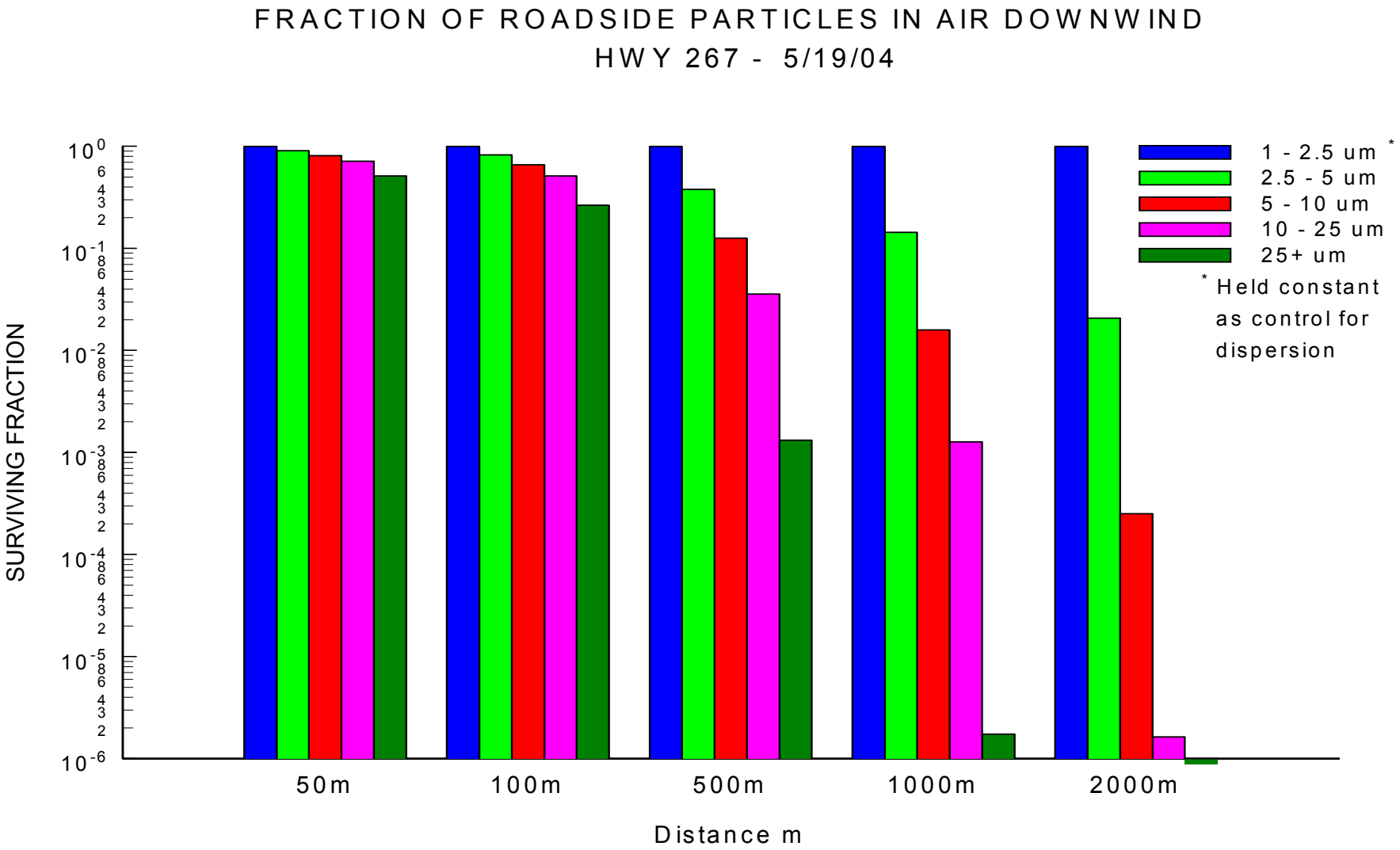
Size Distributions



Road Dust Experiment – Hwy 267

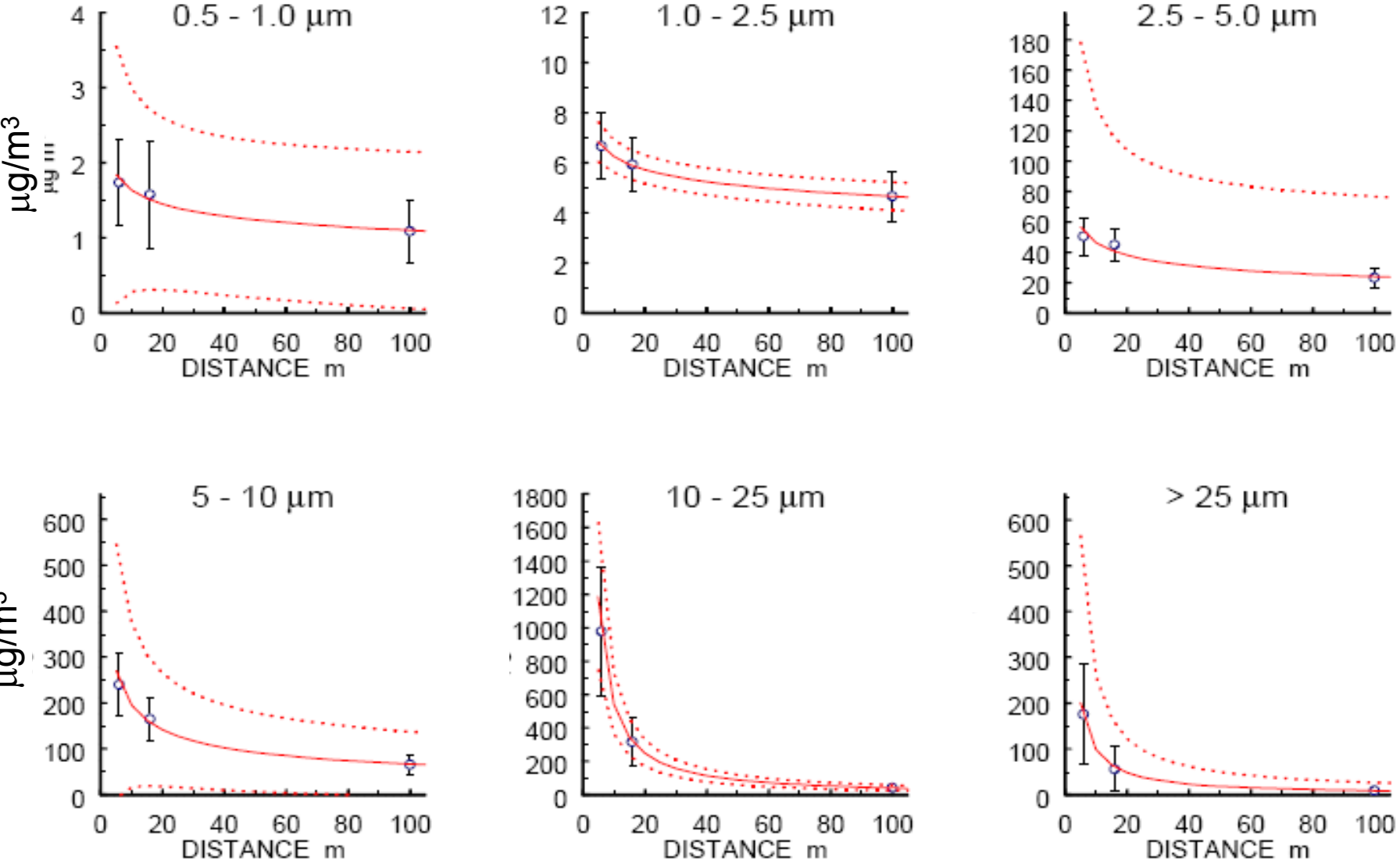


Modeled Dust Drop-off – Hwy 267



Road Dust Decay at SOLA

Shallow Layer Downslope Flow



SOLA Falloff and *RV Franz* Data

Applying these curves:

- Concentrations observed on the *RV Franz* in the urban shore zone (up to 500 m) would be reached about 250 m offshore
- Concentrations measured on the *RV Franz* in open water (>1km) would be reached about 500 m from shore.
- Concentration fall-off over water is strong, but slower than on land, consistent with meteorological theory.

CONCLUSIONS

- PM Concentrations are Related to Local Activity
- PM Concentrations are Strongly Modulated by Local Meteorology
- PM Concentrations and Diurnal Patterns Have High Spatial Heterogeneity
- Concentrations of Large Particles Decay Rapidly Downwind
- Downwind Concentration Decay is Stronger Over Land Than Over Water.
- Land and Water Measurements are Consistent